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EFFECTS OF PERMANENT RESIDENCE WITH FOSTER MOTHERS AND NEW SIBLINGS UPON NUMBERS OF MAST CELLS WITHIN THE THALAMUS OF PREWEANED RATS[1]

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Summary.—In a split-litter, cross-fostered design, the numbers of mast cells per 10 micrometer sections within the thalamic boundaries in rats that had been reared by 8 natural or 8 foster mothers were counted 5 days and 10 days after the transfer had occurred on postnatal Day 10. The rats from 4 litters with the highest numbers of thalamic mast cells exhibited marked reductions in these numbers when fostered by mothers of the 4 litters with the fewest numbers of thalamic mast cells. The reverse influence was not observed. These results suggest that adaptation to changing maternal environments for rats with congenitally elevated numbers of mast cells may increase the risk of degranulation and transient anomalies within cerebral vasculature or the blood-brain barrier.

Mast cells within the brains of young albino rats are found primarily within the thalamus (Persinger, 1977; Dropp, 1979). Their appearance increases in frequency from postnatal Days 1 through 20 and asymptote shortly after weaning (Persinger, 1981). The numbers of mast cells within the thalamus can be affected by daily handling, suggesting that early physical and maternal environments can affect their numbers (Persinger, 1981). Rapid degranulation of mast cells and their constituents can evoke hypotension and transient disruption of the blood-brain barrier (Persinger, 1977).

This experiment was designed to discern if permanent placements in foster mothers' environments, including milk and new siblings, would affect the number of mast cells (MCs) within the thalamus of young preweaned pups. Eight 100-day-old Wistar female rats from Woodlyn Laboratories (Guelph, Ontario) gave birth to healthy litters within a 48-hr. period and were each culled to eight pups (4 males, 4 females). On postnatal Day 10, four of the pups from each litter were earmarked and placed with the other litter. The four remaining pups remained with their biological mothers and were also earmarked on the opposite ear. For each pair of litters the designating earmark for the group (Own, Foster) was reversed.

On postnatal Days 15 and 20, two pups (one Foster, one Own) were selected from each litter so there were equal numbers of males and females per rearing and age condition. After the brains were removed, fixed in ethanol-formalin-acetic acid, and stained with toluidine blue 0, the total numbers of mast cells per slide for 5 10-micrometer coronal slides, equally spaced between the caudal-rostral boundaries of the thalamic parenchyma, were counted at 400X under blind conditions by the second author. On the basis of the numbers of mast cells found in pups reared by their own mothers, the litters were divided into high mast cell ($n=4$) and low mast cell ($n=4$) litters.

Three-way analysis of variance as a function of highest and fewest numbers of mast cells in pups reared by their own mothers, age (15 days vs 20 days) and treatment (natural vs foster

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mother) was completed by SPSS software. The major statistically significant effect was an interaction between litters with high vs low numbers of mast cells and the rearing treatment ($F_{1,6} = 17.71$, $p < .01$; $\eta^2 = .75$). None of the other main effects or interactions (all $F_{1,6}$s < 2.00) were significant. *Post hoc* analyses indicated that the source of the interaction was due to the reduction in numbers of mast cells in pups from high mast cell litters that were fostered by another mother compared to the litter mates who remained with their biological mothers. The means and standard deviations for numbers of mast cells per section for the pups that remained with their mother and fostered pups for the high mast cell litters were 19.6 (*SD*: 8.6) and 5.4 (*SD*: 2.0), respectively. For the low mast cell litters these values were 2.3 (*SD*: 1.8) and 5.6 (*SD*: 3.6), respectively.

The results of this study indicated that alteration of the rearing environment might affect the numbers of thalamic mast cells in some individual rats more than others. Rats from litters with the greater numbers of mast cells displayed a reduction of these cells when fostered by mothers whose litters had low numbers of mast cells. However, rats from litters with low numbers of mast cells did not have a reciprocal increase when they were reared by mothers with litters showing high numbers of mast cells. If the reduction was due to degranulation, then the latter rats would be more vulnerable to the transient effects of the release of the mast cell granules upon the surrounding vasculature.

On the assumption that basic operations associated with rearing probably have similar consequences across species, one may note in human beings, mast cells are found primarily within the area postrema, pineal organ, and choroid plexus (Dropp, 1979). If comparable reductions in numbers of mast cells occurred within these structures following transference from biological mothers to foster mothers, then these historical events may predispose the brain to the consequences of alterations in the blood-brain barrier (Dietsch & Hinrichs, 1989). The secondary effects of stimulating the pineal organ could influence the onset of pubescence. One testable hypothesis is that secondary sex characteristics in fostered children should appear earlier than those in nonfostered children.

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